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ESS ~~522~~ 524

ESS-524

Economic Considerations in Livestock Waste Disposal and Runoff Control

by

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This paper is included in the Ohio Livestock Waste Management Guide published by the Ohio Cooperative Extension Service and the Ohio Agricultural Research and Development Center

Livestock producers are increasingly concerned about livestock waste disposal and runoff control systems. Recent technological, legal, and economic developments have renewed interest in a problem which is as old as the livestock industry. First, the introduction of confinement feeding technology has compounded the problems associated with the disposal of animal wastes. Secondly, society is increasingly demanding feedlot producers as well as other industries to improve or maintain the nation's physical environment. Thirdly, recent price increases in commercial fertilizers have led producers to closely examine the use of wastes as a substitute for commercial fertilizers.

This section views some economic considerations in planning waste disposal and runoff control. First, the tools to use in an economic evaluation of waste disposal systems are presented. Second, the economic impacts of several typical waste disposal systems are summarized for dairy, beef and swine enterprises. Finally, a case farm situation is analyzed to demonstrate the method of evaluating waste disposal systems.

Principle to Use in Deciding on the Type of Waste Disposal and Runoff Control Systems

A tool which may be used readily by the producer is partial budgeting. The partial budgeting technique is used to analyze small or marginal changes in the operation of the farm business. The farmer interested in adopting a waste disposal and runoff control system for his particular operation will find this an easy to use and useful tool.

The technique of partial budgeting analyzes a problem by comparing the impacts of the proposed change in the farm business to the impacts of current production practices. The partial budget is a farm plan that considers only those parts of the farm that will be affected if a small change is made. The format of the partial budget is the following:

	($)		($)
Added Costs	______	Added Income	______
Reduced Returns	______	Reduced Costs	______
Total Negative Impact	______	Total Positive Impact	______

(Positive Impact Minus Negative Impact Equals Net Change)

The livestock farmer would analyze a proposed change in his waste handling and runoff disposal system by comparing the positive impacts with the negative impacts of the proposed change. If the net change is positive, then the new plan would lead to an improvement in net income.

Example of Partial Budgeting

Suppose a farmer has an open lot swine facility and is considering changing to an enclosed, partially slotted building. The economic impacts resulting from the changed housing would need to be analyzed in order to assist the farmer in making the housing decision. The impacts having economic consequences would include the changes in: (a) housing costs, (b) manure disposal and runoff abatement costs, (c) feeding efficiency, (d) labor costs, (e) the value of manure used as fertilizer, and (f) miscellaneous operating costs. Table 1 identifies these changes and the economic impact that each would have on the business.

Table 1

Economic Impacts of a Change of Waste Disposal Methods[a]

NEGATIVE IMPACTS	POSITIVE IMPACTS
1. Added costs of new facilities	1. Reduced costs of old facilities
Depreciation	Repairs
Interest	Taxes
Repairs	Insurance
Taxes	Labor
Insurance	Fuel
Labor	Feed costs under old system
Fuel	Veterinarian
Feed costs of new system	Bedding
Veterinarian	Marketing
Bedding	Misc.
Marketing	
Misc.	2. Increased returns
	Value of manure in a new disposal system
2. Reduced returns	Gross returns from livestock under new system
Value of manure from old disposal system	Interest on salvage price of old facilities
Gross returns from livestock under old disposal system	

[a]All costs and returns are on an annual basis.

Decision makers must make a careful distinction between costs when evaluating a proposed change. Two concepts are important in identifying the relevant costs.

First, all costs must have the same time dimension. The total investment in a durable investment such as a slotted floor and pit cannot be added to the annual operating costs since the slotted floor will be used over a number of years. Rather, all costs must be converted to the same time dimension which is usually an annual basis. Durable inputs (those inputs lasting more than one year) are converted to an annual basis by two items--depreciation and interest. Depreciation is an attempt to identify the amount of the new durable input which is used up in a year, and interest identifies the earnings foregone by investing in the durable input rather than in another investment alternative. Typical annual rates for depreciation of durable inputs are 10 percent for manure disposal facilities and 12 percent for equipment. Typical annual rates for interest are 8 percent of the mid-life value of the durable input or 4 percent of the original cost.

The second concept of use in evaluating waste disposal investments is the difference between fixed and variable costs. Fixed costs are those costs which the firm must bear regardless of the decision made. We do not include these costs in the partial budget. These costs usually are a result of a decision made in the past, and they are costs which our decision will not change. For example, the decision to build an open lot swine facility sometime in the past resulted in some fixed costs which will not change even if we abandon the old facility. We must bear the cost of "depreciation" of the old facility regardless of the decision we now face concerning the durable input's use. Other costs such as property taxes and insurance may also remain the same (fixed costs) regardless of our decision, and "interest" may be a fixed cost if the durable input has no alternative use.

This differential treatment of fixed and variable costs makes it difficult if not impossible to prescribe the "best" waste disposal and runoff control systems for Ohio farms. The producer's current system dictates many of the positive and negative impacts. Also, most of these positive and negative impacts will vary from farm to farm and will depend on the management of the operation and the type of farming. Rather than prescribe systems for Ohio farms, this section will present evidence of some of the impacts which are likely to occur with various systems.

Capital Investments and Annual Costs

Capital investments and annual costs are computed for dairy, beef, and swine enterprises for several waste disposal and runoff control systems at various herd size levels. These systems are only a few of the many systems which are available to producers. These investment and cost computations may give producers some notion of the magnitude of the capital investments and annual costs for common systems.

Dairy

Investments and annual costs are computed for three waste disposal and runoff control systems for dairy and shown in Table 3. The waste disposal systems include (a) open lot, free stall housing, and a scraper loader with runoff controlled by a grass filter strip, (b) enclosed cold housing, free stalls, and a scraper loader system, and (c) enclosed cold housing, free stalls, and a liquid system. It is estimated that these three housing, waste disposal and runoff control systems are used on approximately two-thirds of the farms with dairy herds above 30 head.

The annual costs are derived from past research data, and some of these costs are illustrated in Table 2. These approximations are used for the dairy systems as well as swine and beef systems.

Table 2

Estimated Annual Costs for Machinery and Buildings

Item	Equipment (% of New Cost)	Buildings (% of New Cost)
Depreciation	12.5	10.0
Insurance	.2	.2
Repairs	2.5	1.2
Taxes		.6
Interest (8% of average value)	4.0	4.0
Shelter	.8	
Total (DIRTIS)	20.0	16.0
Fuel, lubricants .03% X new cost X hours of use		

Open lot, free stall housing systems are the most common system seen in the North Central states. Approximately one-half of the dairy farms surveyed in a recent study were of this type.[1] Generally, this system is one of high labor and relatively low capital requirements. Cattle are housed in free stall areas with access to an outside lot. Manure is scraped from the lot surface and free stall housing and is either spread on fields immediately or stored to be spread at a later date. Runoff may be controlled by either a settling basin-retention pond system or a grass filter area. Estimates in Table 3 are based on a grass filter runoff control system with minimal manure storage facilities, and regular spreading of wastes to fields.

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[1]C. R. Hoglund, et. al., "Waste Management Practices and Systems on Michigan Dairy Farms," Ag. Econ. Report 208, Michigan State University, 1972.

Table 3

Capital Investment per Head and Annual Cost per Head for Three Dairy Waste Disposal Systems, Three Herd Sizes, 1975 Price Levels

Housing Type	Dairy Herd Size (Head)		
	50-74	75-99	100 +
	---Capital Investment Per Head ($)---		
Open lot, free stall housing, scraper loader system, grass filter runoff control[a]	197	172	102
Enclosed cold housing, free stalls, scraper loader system[b]	182	146	122
Enclosed cold housing, free stalls, liquid system[c]	299	265	191
	---Annual Costs Per Head ($)---		
Open lot, free stall housing, scraper loader system, grass filter runoff control	65	59	38
Enclosed cold housing, free stalls, scraper loader system	62	56	46
Enclosed cold housing, free stalls, liquid system	75	70	45

[a]Capital investments include purchase price of manure spreader, scraper and loader, tractor, and grass filter strip.

[b]Capital investments include purchase price of manure spreader, scraper, loader and tractor.

[c]Capital investments include purchase price of manure spreader, scraper and loader, tractor, liquid spreader, storage tank, pump, and agitator.

Enclosed covered housing with free stalls and scraper loader system is also a common system according to the survey by Hoglund. About 12% of the dairy housing systems surveyed were of this type, and it is quite similar to the first system described. The only difference between the covered housing with free stalls and the open lot with free stalls is the amount of exposed lot which is available to the animals. In the covered housing system, the animals have minimal access to exposed lots. Thus, the need for runoff control is reduced, and generally the waste is spread over less lot area. As a result of this concentrated area, equipment and labor requirements are slightly less.

Enclosed covered housing with free stalls and a liquid system is a system seen on larger dairy farms. Cows are confined to a lot which often is completely enclosed. Since only a minimal portion of the lot is exposed, runoff control facilities are not needed. During periods when fields are not suited for manure spreading, manure is scraped or pumped into storage tanks. Liquid spreaders are used to spread the stored manure when the fields are accessible. When field conditions are suitable, manure may be loaded and hauled directly from the lots. Generally, this system requires the most capital and least labor of the three systems. The liquid storage tank and covered housing reduce manure runoff to near zero levels, and the system allows for a wide range of flexibility in managing the wastes.

Beef

Capital investments and annual costs are calculated for three beef waste disposal and runoff control systems and are shown in Table 4. The first system is a drylot, unpaved housing system which allows 25 sq. ft. per head of concrete floor and covered housing with 150 sq. ft. per head of unpaved outside lot. Manure is scraped from the facility and spread immediately or stored to be spread at a later date. Runoff control is by means of a runoff retention facility or grass filter area approximately as large as the feedlot area. Labor requirements are relatively large due to the large feedlot area and the need for periodic scraping and hauling. In addition the large feedlot area requires a relatively large runoff retention facility or grass filter area to accommodate the runoff. Cost estimates are based on using the grass filter as the method of runoff control.

The second beef housing system is the drylot, paved system with 25 sq. ft. per head of covered housing and 30 sq. ft. per head of paved outside lot. The waste disposal equipment required with this system is nearly the same as the drylot unpaved system; however, slightly less labor is required due to the reduced lot area. Cattle are generally cleaner on this type of lot and scraping is less of a problem than with unpaved lot surfaces. Runoff control is accomplished by a grass filter at the edge of the feedlot or by a runoff retention facility. Capital investment in the drylot, paved system is slightly greater than the drylot, unpaved system due to the increased capital investment in the concrete lot surface.

Table 4

Capital Investment per Head and Annual Cost per Head for Three Beef Waste Disposal Systems, Three Herd Sizes, 1975 Price Levels

Housing Type	Beef Feedlot Capacity (Head)		
	100	400	700
	-- Capital Investment per Head ($) --		
Drylot, unpaved housing, scraper loader system, grass filter runoff control [a]	99	46	39
Drylot, paved housing, scraper loader system, grass filter runoff control[a]	104	51	42
Confined slotted floor, liquid system[b]	198	121	111
	-- Annual Costs per Head ($)[c] --		
Drylot, unpaved housing, scraper loader system, grass filter runoff control	28	13	11
Drylot, paved housing, scraper loader system, grass filter runoff control	29	14	13
Confined slotted floor, liquid system	41	23	21

[a]Capital investment includes purchase price of manure spreader, scraper, loader, tractor, grass filter and exposed portion of the feedlot.

[b]Capital investment includes purchase price of liquid spreader, pump, tractor, slotted floor and pit. Investment in slotted floor and pit is the difference between the investment in the slotted and pit and the solid floor required in the other two housing types.

[c]A turnover rate of 1.2 is assumed with feeding weights being from 450 to 1050 lbs.

The confined slotted floor system is the third beef housing system. Each animal is allocated 30 sq. ft. of enclosed area. Slotted floors are used with the pit being emptied periodically by a liquid spreader. Runoff control on the feedlot is not a problem since all the feedlot area is covered. Labor requirements for waste disposal are less than either the drylot paved or drylot unpaved systems. Capital investments are substantially higher in the confined system as are annual costs per head; however, feed efficiency generally is improved as compared to the other two beef housing systems.

Swine

The capital investments and annual costs for two waste disposal and runoff control systems are included for swine and are shown in Table 5. The two systems are the enclosed, partially slotted facilities and the open lot facilities. These two systems account for approximately 50 percent of the hog production systems in the Corn Belt and Lake States.

The enclosed, partially slotted facilities allow 7 sq. ft. per head. Approximately half the floor is slotted with the remainder solid concrete. Manure is hauled periodically from the pit. There are no runoff problems on the feedlot since none of the feedlot is exposed. Labor requirements are less under this system than under the open lot system; however, capital investment is higher than under the open lot system.

Approximately 7 sq. ft. per head of sheltered space plus 7 sq. ft. per head of paved lot are allowed in the open front facility. Manure is scraped regularly from the lot and is either spread immediately or stored for spreading at a later date. Runoff should be controlled by a grass filter or a runoff retention facility. The estimates in Table 5 include the grass filter as the runoff control mechanism.

Table 5

Capital Investment per Head of Annual Swine Production and Cost per Head Sold for Two Swine Waste Disposal Systems, Three Herd Sizes, 1975 Price Levels

Housing Type	Annual Swine Production (Head)		
	500	1500	2500
	-- Capital Investment per Head Annual Production ($) --		
Enclosed, partially slotted floor, liquid system[a]	27.70	18.30	16.40
Open front, scraper loader system, grass filter runoff control [b]	23.90	14.00	11.90
	-- Cost per Head Sold ($) [c]--		
Enclosed, partially slotted floor, liquid system	5.80	3.90	3.50
Open front, scraper loader system, grass filter runoff control	7.90	4.80	4.30

[a]Investment includes purchase price of liquid spreader, pump, tractor and partially slotted floor and pit. Investment in the floor is the difference between the total investment in the partially slotted floor and pit and the solid floor required in the open lot system.

[b]Investment is purchase price of spreader, loader, tractor, exposed feedlot surface and grass filter.

[c]A turnover rate of 2.5 is assumed for open front and 3.0 for the enclosed system.

Effects of Systems on Labor Requirements

Labor requirements for alternative livestock waste disposal systems vary widely due to livestock numbers, type of waste disposal system, location of feedlot, seasonality, and the level of management. This variability is reflected in Table 6 which estimates the annual hours of labor required for waste disposal activities on farms with various livestock enterprises, housing systems, and enterprise size levels. Research data used to compile these labor estimates come from a variety of sources including surveys and best estimates of Extension personnel, and these estimates should be used only as approximations of labor requirements of actual systems.

The level of management also varies between waste disposal systems. Generally, the more confined the system, the more management ability is required to solve disease, feeding, and equipment problems which occur with the more intensified systems. The farmer contemplating a change from an open lot to a confined system should realize that his management problems are not reduced by the confinement system. While his labor hours may decline, more managerial effort is required with the confinement system.

Effects of Systems on Feed Efficiency

Research data indicates that the type of housing and waste disposal system has an effect on the rates of gain and feed fed per day for swine and beef. Table 7 shows the average daily gain and feed fed per day on the types of housing and waste disposal systems. Typically, cattle show larger daily gains with the enclosed systems and are more efficient in the use of the feed.

Table 6

Estimated Annual Labor Requirements for Waste Disposal
with Dairy, Beef and Swine Systems of Three Size Levels

	Dairy Herd Size (Head)		
Dairy Systems	50-74 (Hours)	75-99 (Hours)	100 + (Hours)
Open Lot, Free Stall Housing, Scraper Loader System	320	420	510
Enclosed Cold Housing, Free Stalls, Scraper Loader System	300	410	500
Enclosed Cold Housing, Free Stall, Liquid System	240	340	413
	Beef Feedlot Capacity (Head)		
Beef Systems	100 (Hours)	400 (Hours)	700 (Hours)
Drylot, unpaved housing	340	500	680
Drylot, paved housing	280	420	560
Confined, slotted floor housing	220	340	450
	Swine Annual Production (Head)		
Swine Systems	500 (Hours)	1,500 (Hours)	2,500 (Hours)
Totally Enclosed, partially slotted floor	150	220	290
Open Lot	180	270	350

Table 7

Average Daily Gain and Feed Fed Per Day for Feeder Cattle, Three Housing Systems[1]

Housing System	Average Daily Gain[2]	Feed/Day, Pounds Corn	Feed/Day, Pounds Silage
Outside Lot	1.80	6.4	32.8
Partially Covered Lot	2.00	6.4	31.6
100% Covered Lot	2.05	6.4	31.6

[1]Data from J. R. Black and H. D. Ritchie, "Average Daily Gain and Daily Dry Matter Intake of Various Kinds of Cattle Fed Three Different Rations Under Several Environmental Situations," Staff Paper 1973-1, Department of Ag. Econ., Michigan State University, 1973.

[2]Feeding weights are 450-1050 pounds.

Swine rates of gain and feed fed per day are also affected by housing types as shown in Table 8. Generally, enclosed housing and liquid manure systems require approximately the same number of days to feed swine from 30 to 240 pounds but require less feed to accomplish these gains.

Table 8

Average Daily Gain and Feed Fed Per Day for Swine, Three Housing Systems[1]

Housing System	Average Daily Gain, Pounds	Average Daily Feed, Pounds
	30-105 Pounds	
Enclosed, Heated	1.76	3.33
Enclosed, Unheated	1.76	3.61
Open Front	1.65	3.96
	105-240 Pounds	
Enclosed, Heated	1.80	6.36
Enclosed, Unheated	1.80	6.31
Open Front	2.00	7.37

[1]Data from A. H. Jensen, B. G. Harmon, G. R. Carlisle and A. J. Muehling, "Management and Housing for Confinement Swine Production," Circular 1064, University of Illinois, 1972.

Returns From Manure as a Substitute for Commercial Fertilizer

Manure has value as a substitute for commercial fertilizer; however, the price tag to place on the manure is difficult to calculate due to the differences in the nutrient content of the manure. The nutrient value depends on the type of animal, weight of animal, ration, housing system, bedding material used, storage system, time of the year in which the waste is spread, and commercial fertilizer prices. Table 9 approximates the annual value of fertilizer nutrients for dairy, swine and beef under alternative housing and disposal systems.

Differences for fertilizer values between housing and disposal systems in Table 9 are explained by the differences in the percent of nitrogen remaining after storage and spreading under various systems. Systems which allow for solid spreading generally have a higher percentage of nitrogen remaining after storage and spreading than those systems with irrigation or liquid spreading.

It should be noted that the data in Table 8 refer to the average annual value of manure per head. Thus, if a farmer had a confined hog facility with an averaged 500 head in the facility throughout the year and the swine averaged 100 lbs. per head, the value of the manure would be $2,700 under current fertilizer prices ($5.4/head from Table 9 times 500 head).

Table 9
Annual Value of Manure Produced by Dairy, Beef and Swine as a Substitute for Commercial Fertilizer Under Six Waste Disposal Systems, 1975 Price Levels

	Annual Value of Manure per Animal Unit[1]		
	Dairy (1000 lb. animal)	Beef (900 lb. animal)	Swine (100 lb. animal)
Bedded building, solid spreading	$57	$51	7.4
Open lot, solid storage, solid spreading	43	41	5.9
Aerobic lagoon, irrigation or liquid spreading	43	41	5.9
Deep pit storage, liquid spreading	38	37	5.4
Anaerobic lagoon, irrigation or liquid spreading	35	34	4.9
Oxidation ditch, anaerobic lagoon storage, irrigation or liquid spreading	35	34	4.9

[1]Price assumptions for nutrients-N=$0.30/lb., P_2O_5=$0.20/lb., K_2O = $0.11/lb.

Example of Partial Budget

The partial budget presented earlier provides a method of modeling the economic consequences in order to determine the most profitable decision. The economic consequences for some livestock systems have been approximated and the following example uses this data to demonstrate how the partial budget may be used.

Assume a beef farmer is considering changing disposal systems. He currently has a 400 head capacity feedlot with a drylot, unpaved construction. He is contemplating changing his beef production and waste disposal system to a totally confined, slotted floor, liquid waste system. A new building would be required and the old facilities would be salvaged.

The existing facilities and equipment have been on the farm for several years and the current salvage value is considerably less than the capital outlay when purchased new.

Investment in Old System of Example Farm

	New Cost	Salvage Value of Old Equipment & Buildings
Building	$25,000	$ 0
Manure Spreader	3,384	1,000
Loader	3,266	1,000
Grass Filter	900	700
Feedlot	900	600
Total Salvage Value of Investment		$ 3,300

The housing and waste disposal system would require the following capital outlays:

Investments in New System of Example Farm

	Cost
Liquid Spreader	$ 5,100
Pump	2,600
Slotted Floor and Pit	8,100
Building ($2.70/sq. ft. X 30 sq. ft./head X 400 head)	32,400
Total	$48,200

From these investment estimates and the estimates of economic impacts in Tables 1-9, a partial budget is prepared in Table 10 to demonstrate those considerations the producer should use in budgeting.

Table 10

Partial Budget of Proposed Change--Example Farm

Negative Impacts

Increased Annual Costs	
DIRTIS on equipment[1] (20% X $7,700)	$ 1,540
DIRTI on building[1] (16% X $40,500)	6,480
Labor[2] (340 hrs. X $3.00/hr.)	1,020
Fuel, lubricants, electricity[3] (.03% X $7,700 X 340 hrs. X .5)	393
Feed costs[4]	
—corn ($2.50/bu. X 400 head X 360 days X 6.4 lbs. ÷ 56 lbs./bu.)	41,143
--silage ($18/ton X 400 head X 360 days X 31.6 lbs. ÷ 2000 lbs./ton)	40,954
Purchased calves[5] (1.23 turnover rate X 400 head X 450 lbs./head X .40/lb.)	88,560
Vet., marketing, misc. ($18.50/head)	9,100
Interest on operating costs (8% X operating costs/2)	7,290
Reduced Returns	
Value of manure from old system[6] ($50/head X 400 head)	20,000
Gross returns from beef under old system[7] (1.20 turnover rate X 400 head X 1050 lbs./head X $ .44/lb.)	221,560
Total Negative Impacts	$438,040

Table 10 (Continued)

Positive Impacts

Decreased Annual Costs	
Equipment -- repair, taxes, insurance, shelter[8] (7.3% X new cost)	$ 485
Building -- repair, taxes, insurance, shelter (6% X new cost)	1,608
Interest[9] (8% X salvage value)	264
Labor (500 hrs. X $3.00/hr.)	1,500
Fuel, lubricants, electricity (.03% X $6,650 X 500 days X .5)	499
Feed costs[10]	
--corn ($2.50/bu. X 400 head X 360 days X 6.4 lbs. - 56 lbs./bu.)	41,143
--silage ($18/ton X 400 head X 360 days X 31.6 lbs. - 2000 lbs./ton)	40,954
Bedding (0.5 ton/head X 400 head X $3/ton)	600
Purchased calves (1.2 turnover rate X 400 head X 450 lbs. X $ .40)	86,400
Vet., marketing, misc. ($18.50/head)	8,880
Interest on operating capital (8% X operating costs/2)	7,268
Increased Returns	
Value of manure from new system ($38 X 400)	15,200
Gross returns from beef under old system (1.23 X 400 head X 1050 lbs. X lbs. X $0.44/lb.)	227,304
Total Positive Impacts	$432,105
Net Impacts	$ -5,935

[1]Depreciation, interest, repair, taxes, insurance, shelter from Table 2

[2]Annual hours of labor are from Table 6

[3]Fuel, lubricants, etc. are from Table 2. It is assumed that machinery is being used during one-half of the labor hours

[4]Feed costs are based on Table 7, with the assumption of corn at $2.50/bu. and silage at $18/ton

[5]The turnover rate is based on data in Table 7. If cattle gain 2.0 lbs./day, they can gain 600 lbs. in 300 days. The turnover rate would be 300/360 or 1.2

[6]Manure value based on Table 9

[7]Price assumptions for cattle-slaughter cattle, $.475 per lb. and feeder cattle, $ .40 per lb.

[8]Data from Table 2. Note that depreciation is not included since it is a fixed expense

[9]Interest charged for equipment and buildings in use is the annual return being sacrificed in order to keep this equipment and building in its present use. The annual sacrifice or opportunity cost is the interest rate times the salvage price.

[10]Feed costs are based on Table 7

Results of this partial budget would indicate that the farmer should not change his housing and waste disposal system to the more confined system. Net impacts are -$5,935 and the farmer should consider other systems or continue production on the old system.

This decision to not invest in the new facility was based on purely economic grounds. The farmer also should be aware of the legal and environmental outcomes of his decision. If legal constraints require him to lessen water pollution from his facilities, the economic impact from the partial budget is only one set of information to be used in making his decision. Similarly, the farmer interested in preserving or enhancing the environment would use more information than the results from the partial budget in making his decision.

Summary

The choice of a manure disposal and runoff control system may be a decision affecting all phases of the livestock operation. Not only should the costs of the waste disposal and runoff control facility be considered in the decision, but also the effects of the new system on housing costs, feeding efficiency, labor requirements, and the utilization of manure as a fertilizer.

This section has offered the partial budgeting technique as a tool for the farmer to use in making this complex decision. The partial budget allows the farmer to consider those impacts which a proposed change would have on the profitability of his business. Also, research data concerning capital investment, annual costs, feed efficiency, and the value of manure as a fertilizer have been cited to assist the farmer in analyzing manure disposal and runoff control systems for his unique farm situation.